Marama bean seed multiplication in Namibia: An Overview and the Future

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28th August 2024




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An overview of work undertaken during the past 5 years for (Marama bean)



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OBJECTIVES

The objectives of the Marama bean project were to:

1. Multiply seeds for distribution to collaborating partners
2. To enhance collaborations amongst researchers in the fields of sustainable agriculture, climate and environmental science, and agricultural economics in India and in Africa;
3. To strengthen capacity of institutions and the researchers





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EXPECTED OUTPUTS

1. Multiplied seeds for distribution
2. Eased community's adaptation of germplasm and low-cost agri-based technologies;
3. Increased climate resilient farming.



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Mungbean and Mothbean Requests

- The most popular crop with the farmers was Mungbean and Mothbean
- January 2024 : gave seeds of mungbean and Mothbean to two Divundu farmers

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MARAMA BEAN (TYLOSEMA ESCULENTUM)

a

b

c

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Marama bean production challenges

1. Low seed Yield (300-500kg/ha)
2. Long seed-to-seed period (18 -20 months)
3. Overcoming the out-crossing barrier



Marama bean Production Areas Climate




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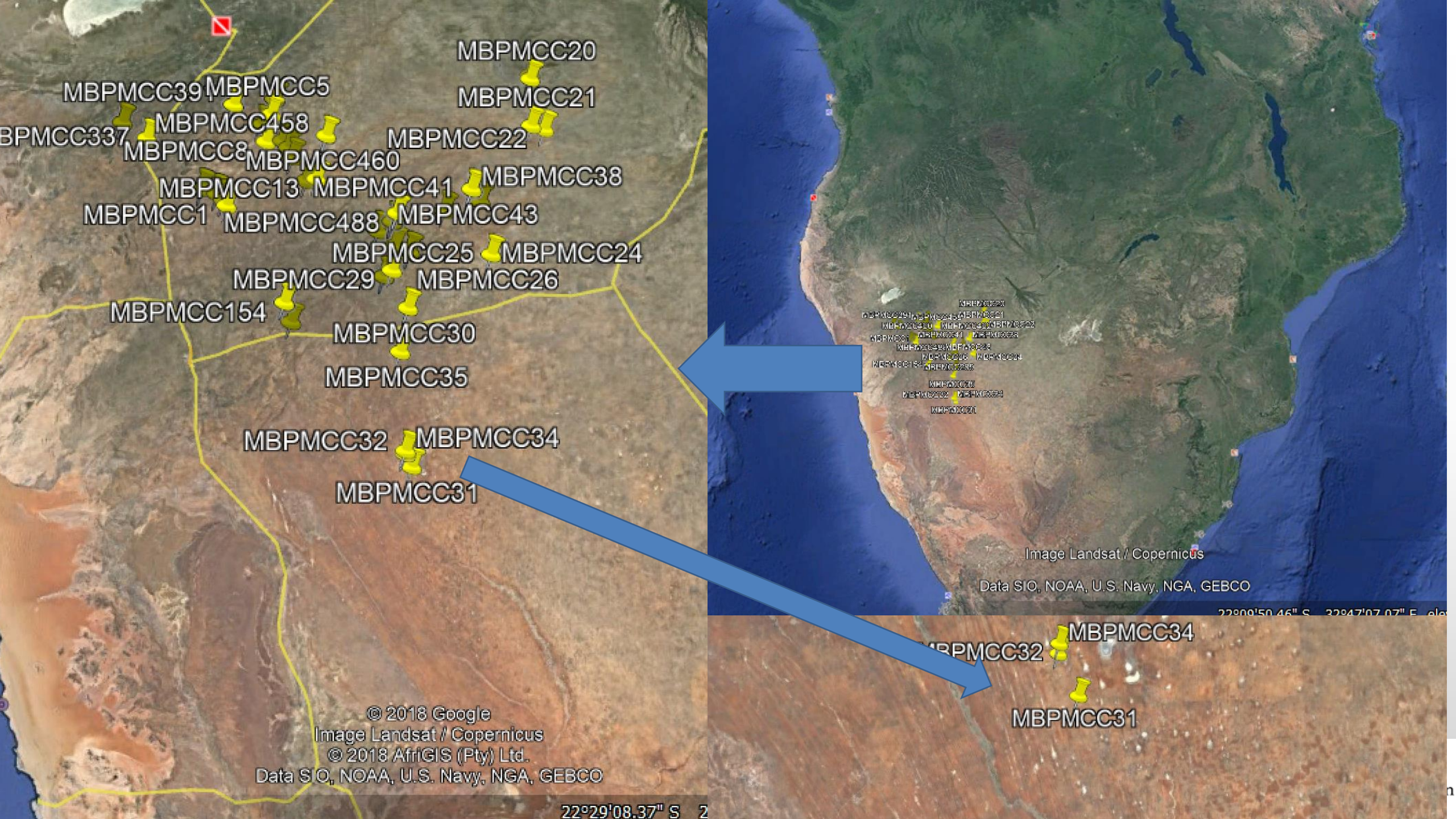
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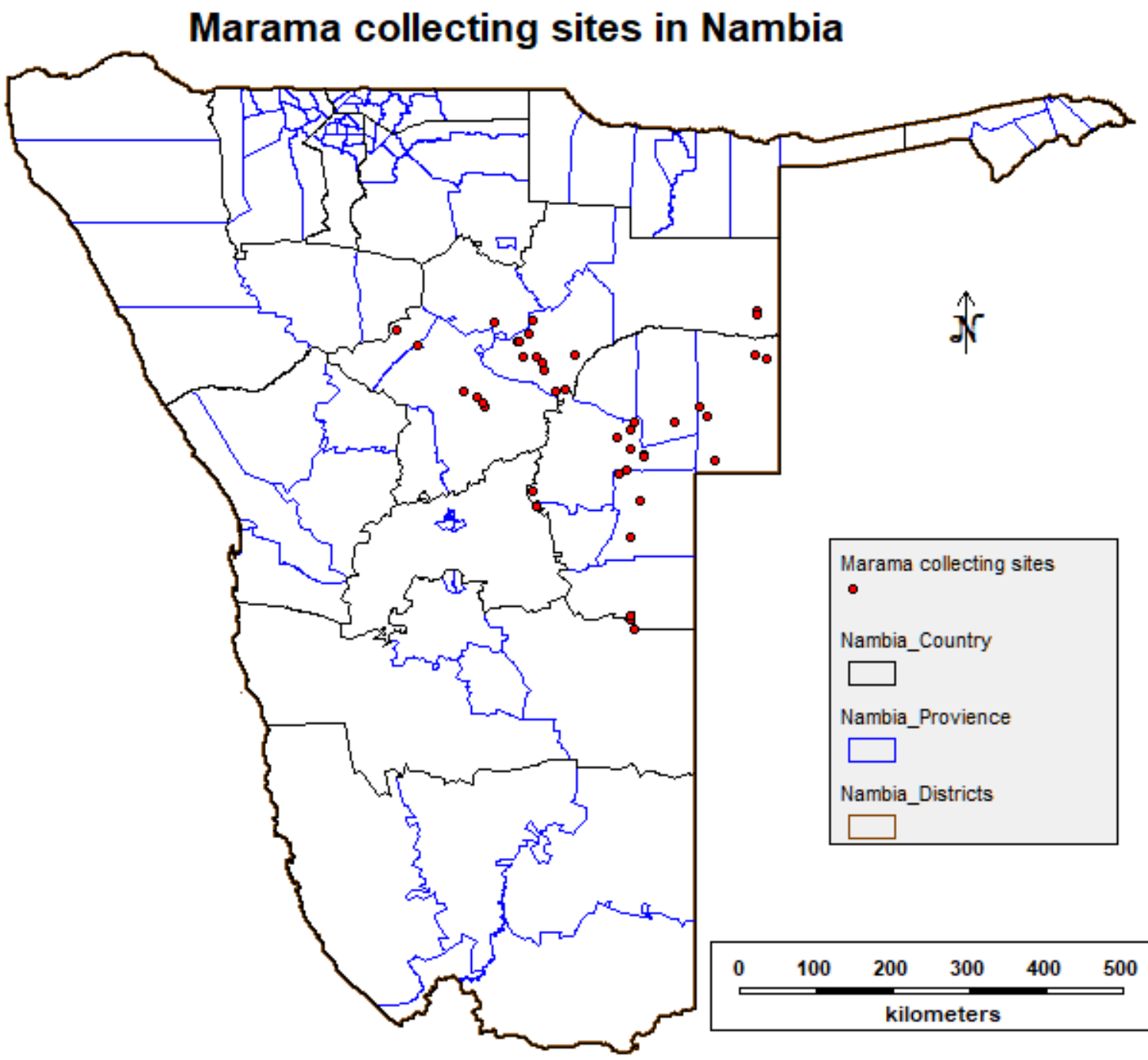
MBPMCC31

521 marama bean accessions across 40 target collecting sites collected in Namibia and are being kept at 4°C at NUST



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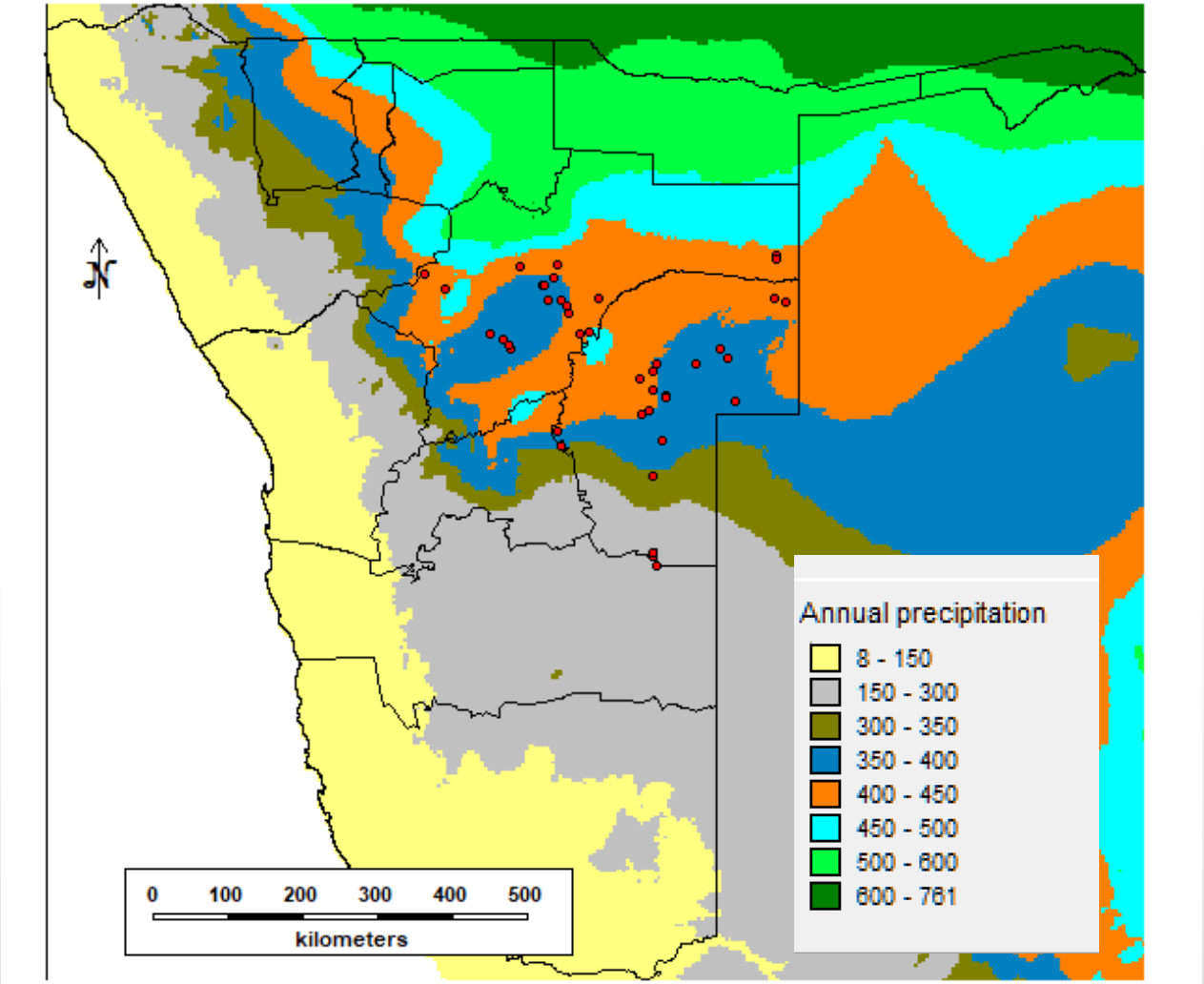
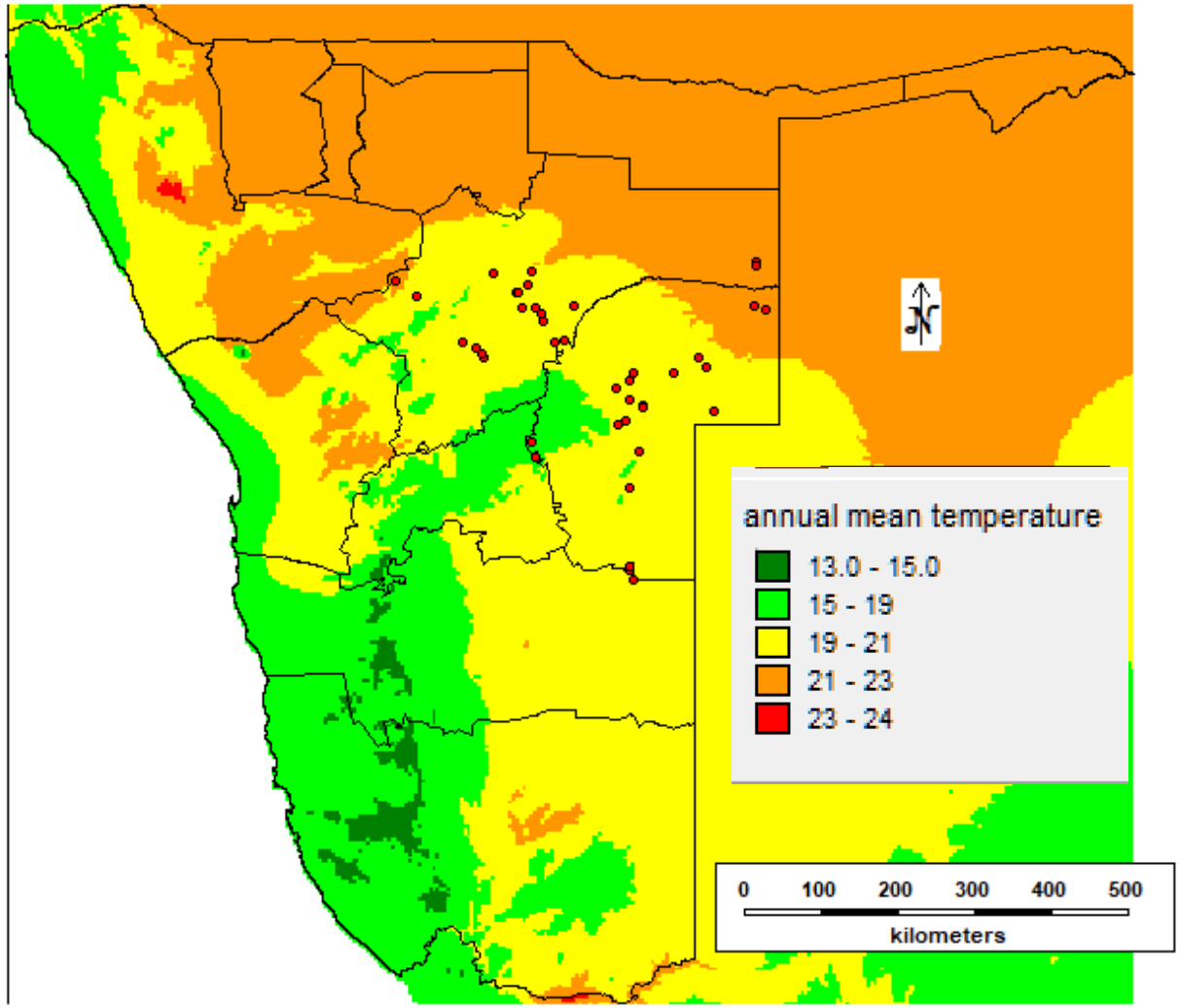
Mean pricipitation across marama collecting sites in Nambia

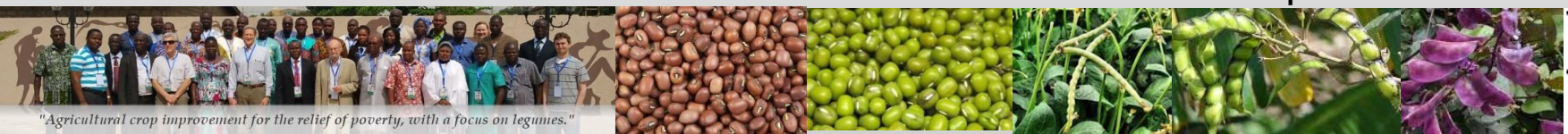


Most collections are from 350 to 450 mm annual rainfall zone

Mean temperature across marama collecting sites in Nambia



Most collections are from 19 to 21°C mean temperature zone



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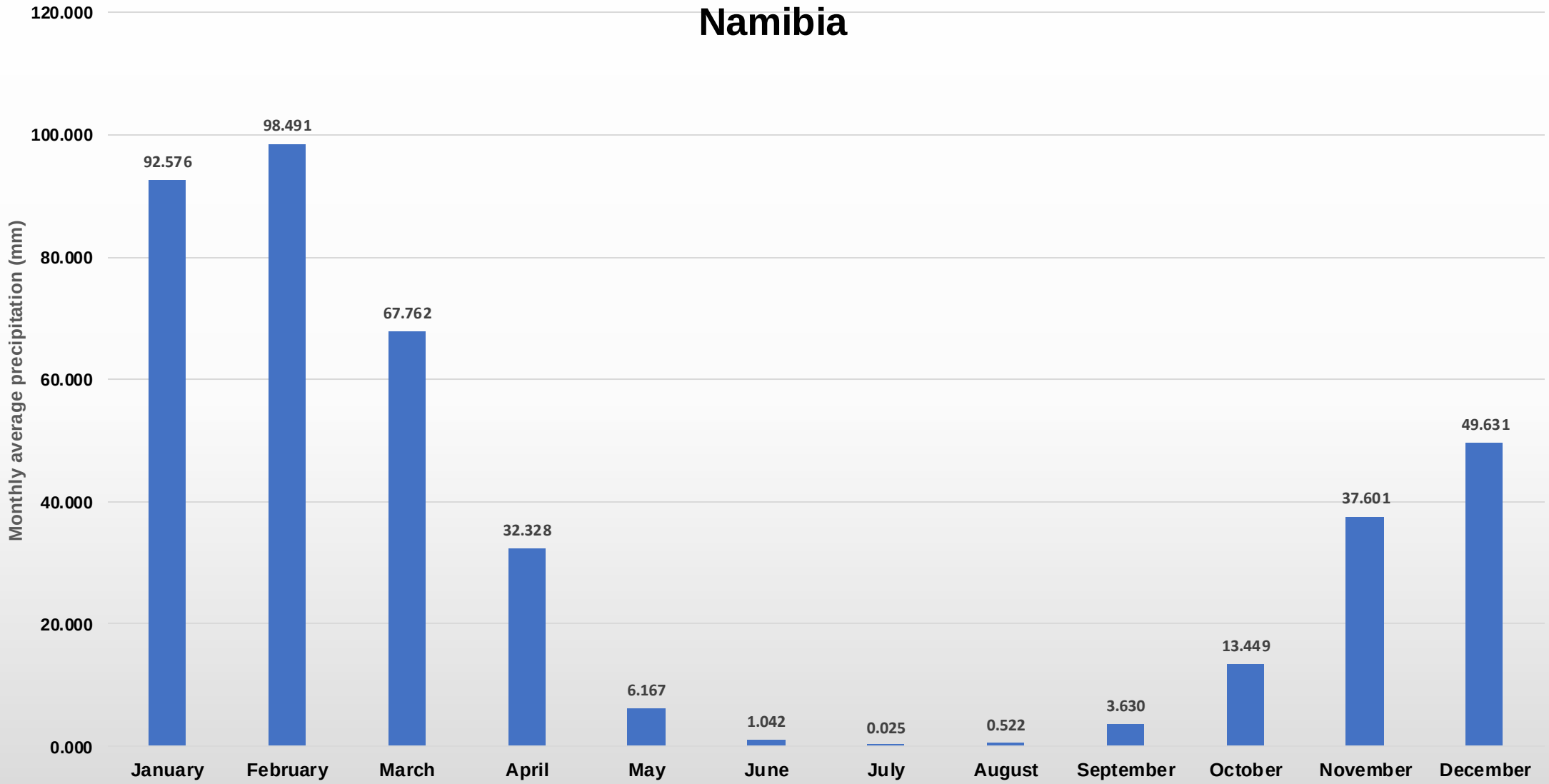
Monthly average precipitation of marama bean collecting sites in Namibia



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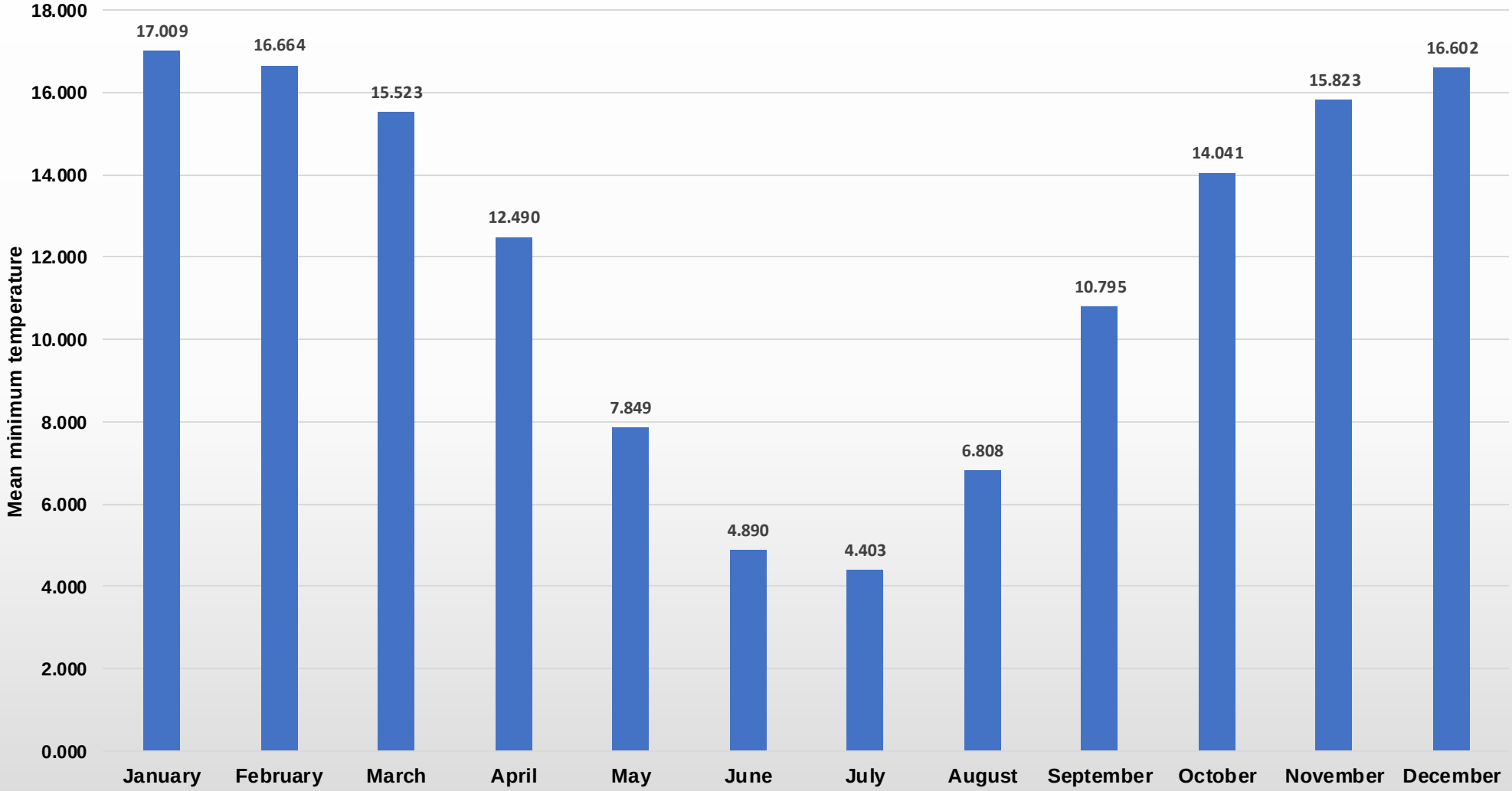
Monthly average minimum temperature of marama collecting sites in Nambia



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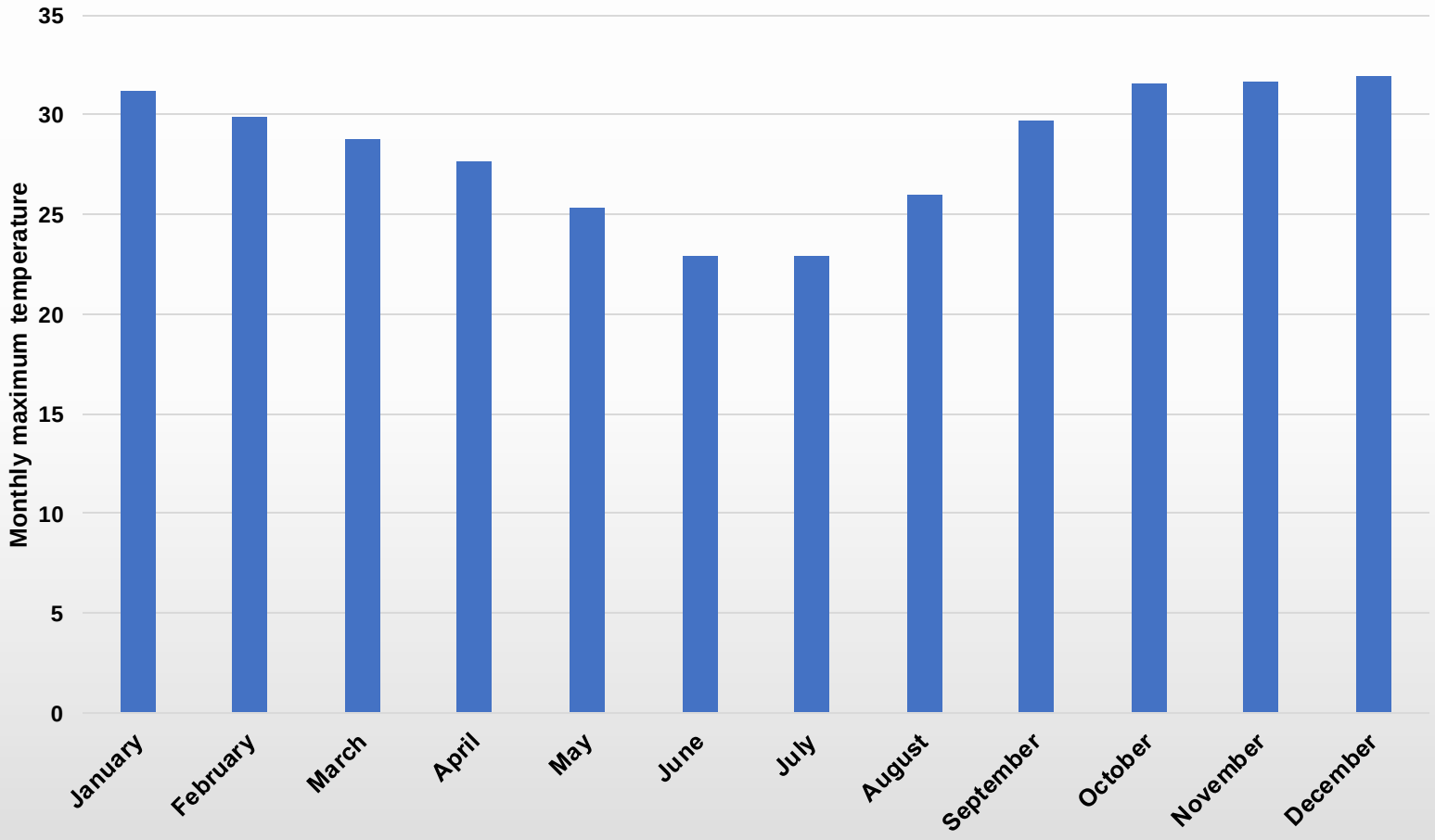
Monthly average maximum temperature of marama collecting sites in Nambia



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Criteria for germplasm selection

- 50 accessions out of 521 accessions collected (since 2008)

General characteristics recorded

- Seeds/pod
- Seed colour
- Internodal length
- Flowering time

Criteria for germplasm selection

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- Seed colour
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Current project site: Okatumba gate, Eiseb Omaheke region

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Criteria for germplasm selection and planting

- 50 accessions out of 521 accessions selected
- 16seeds/accession: 800 seeds /2ha
- 5metre distance/seed, 15-20cm planting depth
- Choosing the 1 seed/pod (PMCMB1-10); 2 seeds/pod (PMCMB100-10) and 3 seeds/pod (PMCMB200-210)
- Ensuring selection varying geographical locations
- 20 accessions (Both early and late) flowering groups selected for production (early light brown: PMCMB 300-310), (late, light brown:PMCMB400-410)
- PMCMB 309, 2 seed/pod, 5 pods/flower)
- 95% germination rate




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521 accessions recorded on database

530 current (add Gam and Tsumkwe from 2024 field campaign

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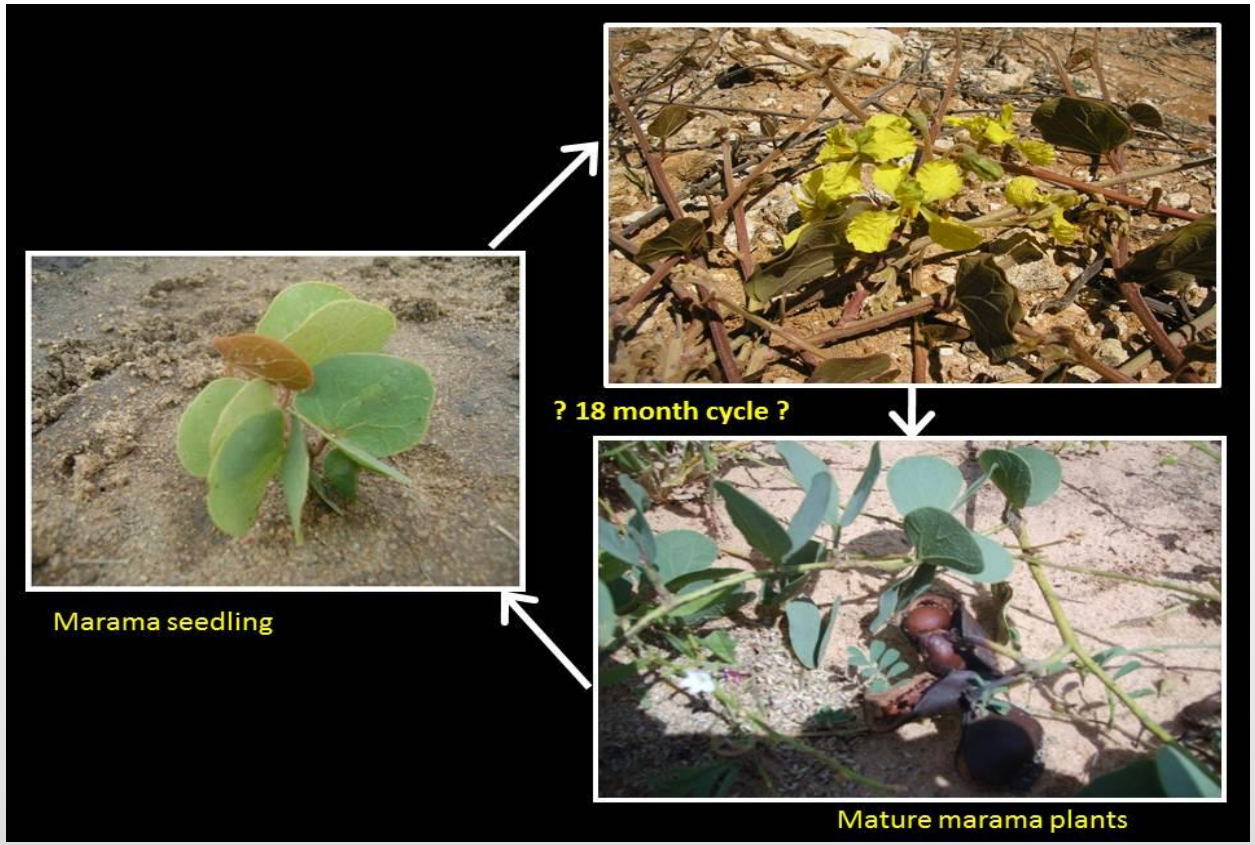
Marama bean: Life cycle



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Marama tuberous root rich in edible and industrial starch

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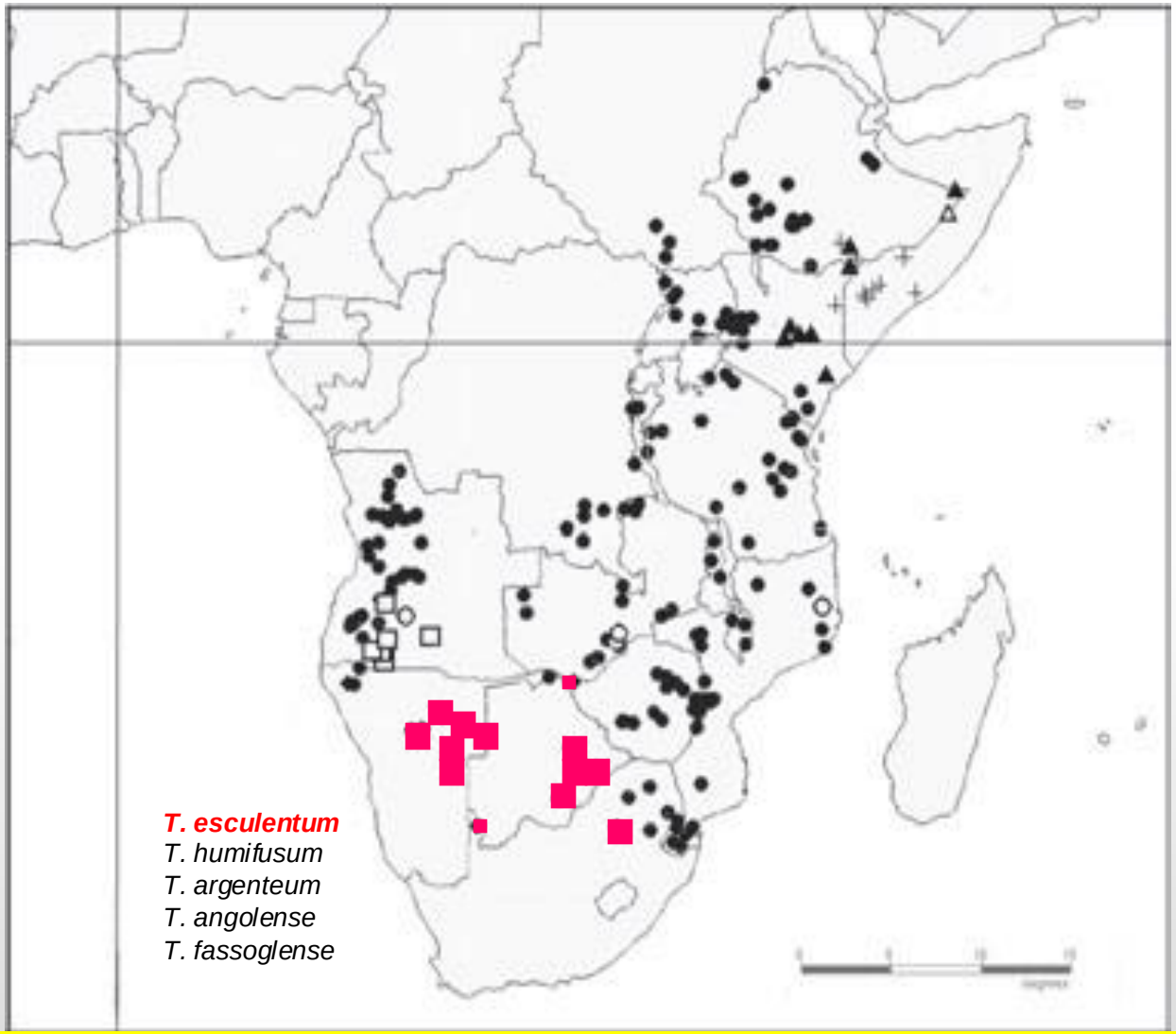

Species distribution of Marama bean in Africa

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Crop Management protocols

- Tractor ploughing
- Plot de-bushed
- Weeding not yet done, no weeds yet in the plot
- Mesh wire fencing to keep rodents and other wild animals out of the field
- No irrigation yet
- No fertilizer application yet

Associated work

- WFP PROGRAMME:
  - Home grown school feeding Program (Marama bean & Moringa)
- Dr Paidamoyo Mataranyika: Plant-Microbe Interactions on STOL crops [Now post doc at Imperial College in London, UK]
- **Food security and Nutrition Improvement by Fostering protein-rich legume using low-cost Biotechnology in Namibia (FOODSECBIO).**

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Plant Microbe Interactions on STOL crops: search for plant growth promoting bacteria




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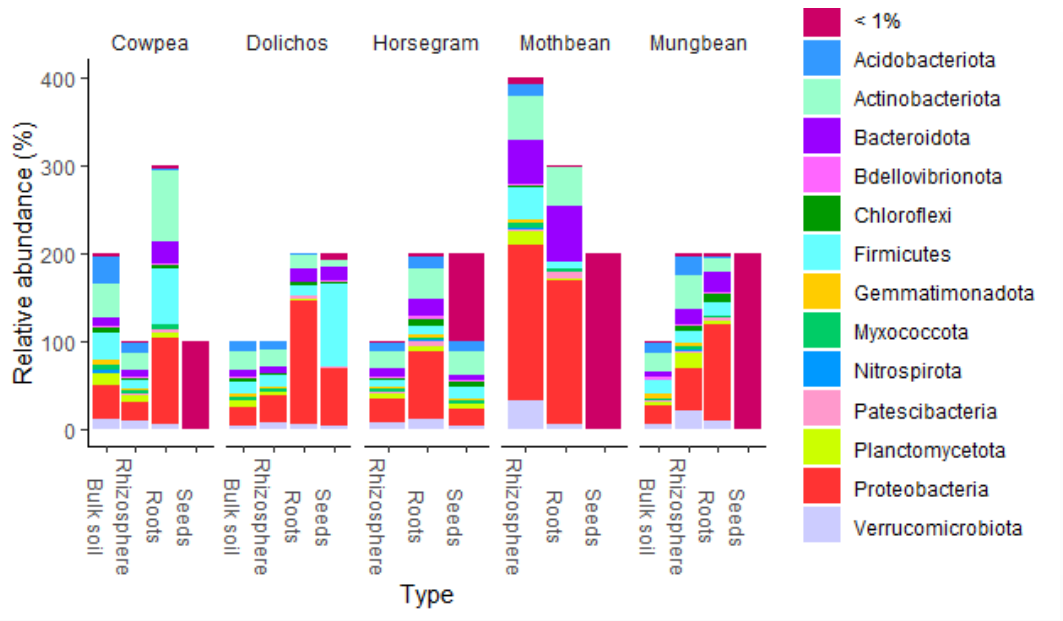
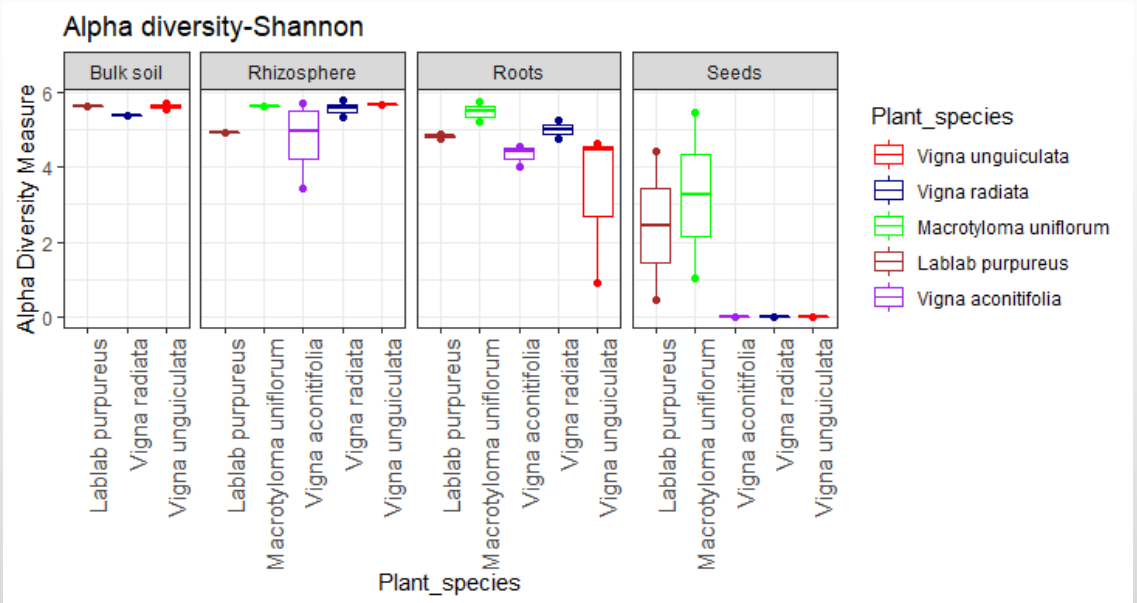
Nodule formation

Horsegram nodules

Horsegram (*M. uniflorum*)
Average number of nodules/ plant- 10
Nodule size- 2mm-5mm

Horsegram isolates





- Diversity was observed to decrease from bulk soil, rhizosphere, roots and seeds.
- Several plant growth promoting genera were identified
  - *Rhizobium*
  - *Bradyrhizobium*
  - *Allorhizobium-Neorhizobium-Pararhizobium-Rhizobium*
  - *Pseudomonas*
  - *Bacillus.*

MARAMA BEAN MONOGRAPH

Project finalised in 2024

TYLOSEMA ESCULENTUM (MARAMA BEAN)
A Monograph

Percy Chimwamurombe

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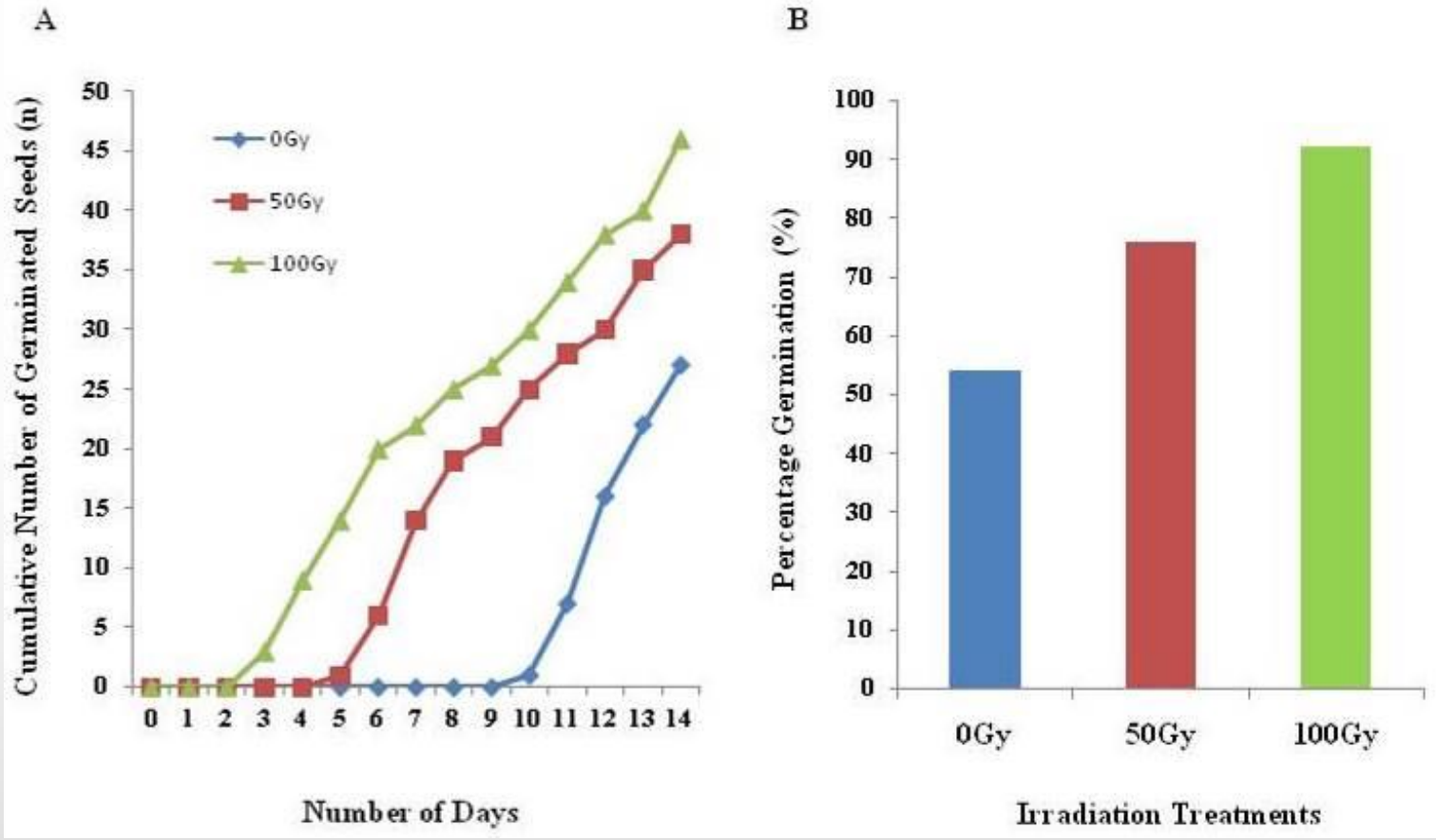
Gamma irradiation increase germination rates



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Potential soil cover crop- range land recovery in arid zones

Potential soil cover crop-range land recovery in arid zones

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Season 2023-2024 Production Work

1. During the reporting season all plans resprouted rate of (608 out of 640 plants) from the first sowing
2. All the 50 accessions were represented in these germinated plants.
3. Severe drought in Namibia
4. Total harvested seeds: 300 kg (expected about 800kg) on the 4 hectare plot
5. So far no insect, other pests or rodents have been observed to cause damage in the field.




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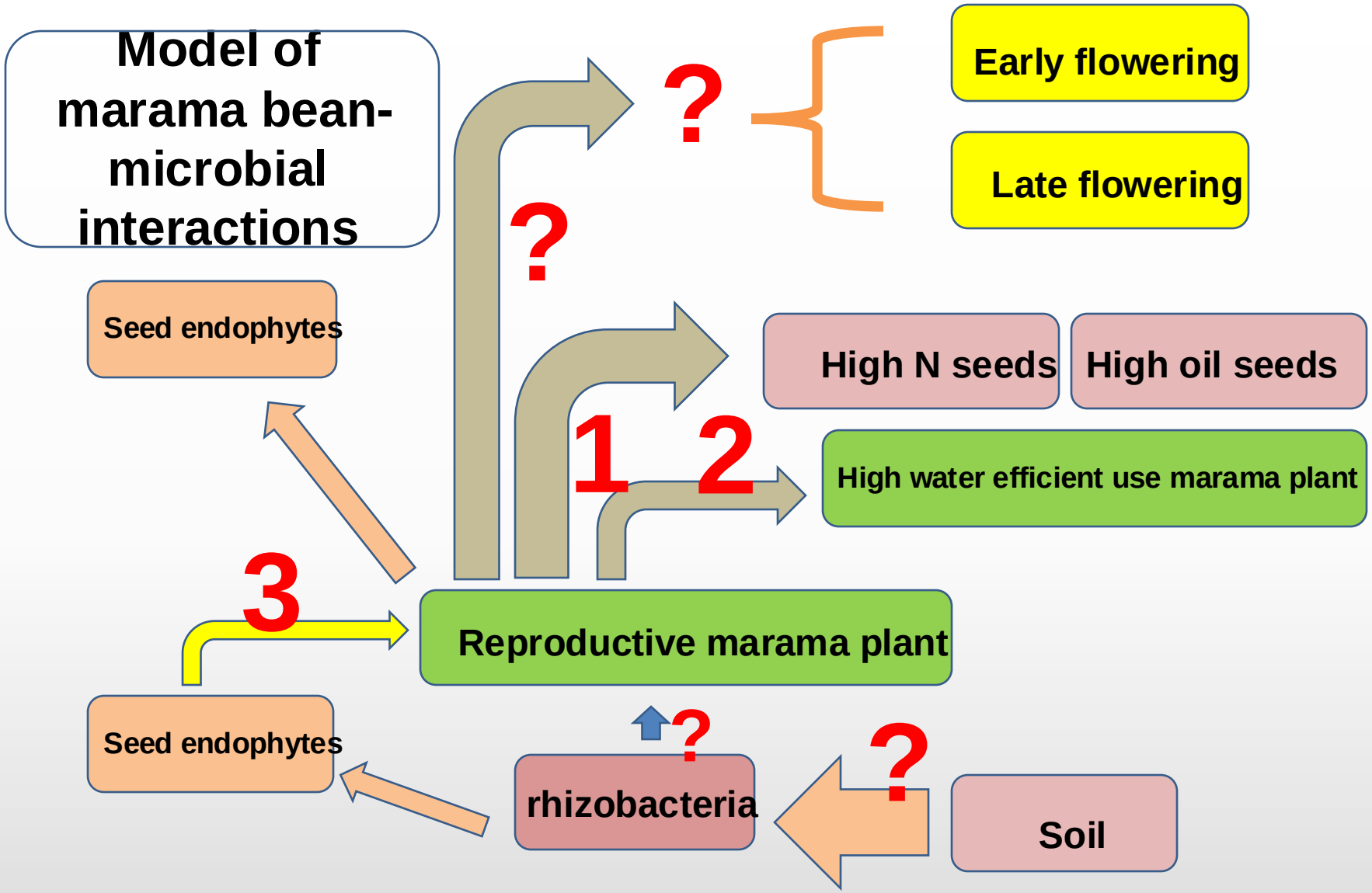
Model of marama bean-microbial interactions



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Future of Marama bean development: Work in Progress for KT consideration

“Greening the Desert”: Accelerating the change of Marama Bean into a high value desert crop through genome sequencing and computational proteomics




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Objectives

To perform an in-depth comparative proteomics study to identify genes and pathways involved in the critical areas of improvement: **number of seeds per pod, seed to seed cycle, and drought tolerance.**

Approach

1. **Accelerating the improvement of Marama bean beyond traditional breeding methods.**
2. **Sequencing several varieties of Marama bean from the Marama bean seed bank at NUST and construct their proteomes using the state-of-the-art computational proteomics methods**

Proposed Approach has already been successfully applied for Soybean improvement research





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ACKNOWLEDGEMENTS

- KIRKHOUSE TRUST
- MARAM BEAN DOMESTICATION TEAM
- JULIA SEPE
- ABIUD KAMBURONA
- PAIDA MOYO MATARANYIKA
- JEAN DAMASCENE UZABAKIRIHO

Thank you


"Agricultural crop improvement for the relief of poverty, with a focus on legumes."
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